

Claims

1. Coating comprising a non-vaporising getter metal alloy (2) for an inner wall (3) of an ultra-high-vacuum vessel (4), the getter metal alloy (2) comprising at least one getter metal having a melting point above 1,500°C and a vaporisation temperature above 3,000°C,
characterised in that
the getter metal alloy coating (1) is not encumbered with noble gas inclusions and comprises a metal alloy deposition product from a noble-gas-free getter metal alloy plasma (6).
2. Coating according to claim 1, **characterised in that** the getter metal alloy (2) comprises titanium, zirconium and/or vanadium.
3. Coating according to claim 1, **characterised in that** the getter metal alloy (2) comprises titanium, zirconium and/or hafnium.
4. Coating according to claim 1, **characterised in that** the getter metal alloy (2) comprises vanadium, zirconium and/or hafnium.
5. Coating according to one of claims 1 to 4, **characterised in that** the getter metal alloy (2) has an activation temperature between 120°C and 500°C.
6. Coating according to one of claims 1 to 4, **characterised in that** the getter metal alloy (2) has an activation temperature below 200°C and above 120°C.
7. Coating according to one of claims 1 to 4, **characterised in that** the getter metal alloy (2) has an activation temperature above 250°C and up to 500°C.
8. Arrangement for the production of a getter metal alloy coating (1) on an inner wall (3) of a high-vacuum vessel (5) to be coated, according to one of the preceding claims,
characterised in that
the arrangement comprises a metal plasma generator (7), which comprises the following components:

- an insulator member (8) having an ignition electrode (9) and having a cathode wire (10) comprising a getter metal alloy (2), the ignition electrode (9) and cathode wire (10) being connectible to an ignition pulse generator (11) and to a cathode potential (12), respectively, and being arranged on the insulator member (8) spatially separated from one another,
 - a cage-shaped anode member (13), which surrounds the insulator member (8), spatially spaced (d) apart therefrom, and which is connectible to an anode potential (14), the insulator member (8) and the surrounding anode member (13) projecting, during coating, into the interior (15) of the high-vacuum vessel (5) to be coated,
 - a voltage supply apparatus (16) having a cathode potential switching device (17) for application of the cathode potential (12) by way of a vacuum port (18) to the cathode wire (10) and for the application of a high-voltage ignition pulse (19) by way of a vacuum high-voltage port (20) to the ignition electrode (9) and for the connection of the anode potential (14) to the high-vacuum vessel (5) to be coated and to the anode member (13).
9. Arrangement according to claim 8, **characterised in that** the arrangement comprises a metal plasma spray head (21), which comprises the insulator member (8) having the cathode wire (10) and ignition electrode (9) and which is arranged to be movable under a high vacuum within the interior (15) of the high-vacuum vessel (5) to be coated.
- 10 Arrangement according to claim 9, **characterised in that** the arrangement comprises a high-vacuum slide-through port (22), which makes possible linear displacement of the metal plasma spray head (21) within the interior (15) of the high-vacuum vessel (5) to be coated.
11. Arrangement according to claim 8, **characterised in that** the arrangement comprises a metal plasma spray rod (23), which comprises an insulator rod (24) as insulator member (8) having an ignition electrode (9) and, on its envelope surface (25), a wound-on cathode wire (10) and also the surrounding anode member (13) and which is arranged in the interior (15) of the high-vacuum vessel (5) to be coated.
12. Arrangement according to claim 11, **characterised in that** the insulator rod (24) has a cone (26) in the axial direction, the radius of which increases in the axial direction towards the end face (27) of the insulator rod (24).

13. Arrangement according to claim 12, **characterised in that** the insulator rod (24) has a cone angle (α) between 1° and 15°.
14. Arrangement according to one of claims 9 to 13, **characterised in that** the arrangement comprises a rotary port (28) for the metal plasma spray rod (23) and/or the metal plasma spray head (21).
15. Arrangement according to one of claims 9 to 14, **characterised in that** the arrangement comprises a supporting flange (29), which carries the metal plasma spray rod (23) and/or the metal plasma spray head (21) and which is arranged to be flange-mounted in high-vacuum-tight manner on the high-vacuum vessel (5) to be coated.
16. Arrangement according to one of claims 8 to 15, **characterised in that** the cage-shaped anode member (13) is formed by a wire grating (30).
17. Arrangement according to one of claims 8 to 15, **characterised in that** the cage-shaped anode member (13) is formed by a perforated plate.
18. Arrangement according to one of claims 8 to 17, **characterised in that** the anode member (13) comprises a high-melting metal alloy having a melting point above 1,500°C and a vaporisation temperature above 3,000°C.
19. Arrangement according to one of claims 8 to 18, **characterised in that** the anode member (13) comprises a getter metal alloy (2) which has a higher vaporisation temperature than the cathode wire.
20. Arrangement according to one of claims 8 to 19, **characterised in that** the ignition electrode (9) is arranged at that end face (27) of the insulator member (8) which projects into the high-vacuum vessel (5).
21. Arrangement according to one of claims 8 to 20, **characterised in that** the insulator member (8) comprises a cylindrical ceramic tube (31) comprising, in its axial region (32), a supply wire (33) to a central metal plate (34) as ignition electrode (9) at the end face (27) of the insulator member (8).

22. Arrangement according to one of claims 8 to 20, **characterised in that** the insulator member (8) comprises a ceramic ring (35), the ring opening (36) of which comprises a bundle (37) of cathode wires (10) and which carries a metal ring (38) as ignition electrode (9), which is in operative connection with the voltage supply apparatus (16) by way of an ignition supply line (39).
23. Arrangement according to one of claims 8 to 22, **characterised in that** the ignition electrode (9) comprises a high-melting metal alloy having a melting point above 1,500°C and a vaporisation temperature above 3,000°C.
24. Arrangement according to one of claims 8 to 23, **characterised in that** the ignition electrode (9) comprises a getter metal alloy (2) which has a higher vaporisation temperature than the cathode wire (10).
25. Arrangement according to one of claims 8 to 24, **characterised in that** the high-vacuum vessel (5) to be coated is a beam guidance tube (41) of an ion beam acceleration system.
26. Method for the production of a coating (1) comprising a non-vaporising getter metal alloy (2) on an inner wall (3) of a high-vacuum vessel to be coated, the getter metal alloy (2) comprising at least one getter metal having a melting point above 1,500°C and a vaporisation temperature above 3,000°C, and the method comprising the following method steps:
- ignition of a light arc (42) between a cathode wire (10) comprising a getter metal alloy (2) and an anode member (13) by means of a high-voltage ignition pulse (19),
 - continuing conversion of the cathode wire (10) into a getter metal alloy plasma while maintaining a metal plasma light arc (43) between the cathode wire (10) and a cage-shaped anode member (13) spatially surrounding the cathode wire (10),
 - plasma coating, under a high vacuum, of the inner wall (3) of the high-vacuum vessel (5) to be coated,
 - gas-tight closure of the coated ultra-high-vacuum vessel (4) after coating.
26. Method according to claim 26, **characterised in that**, for ignition of the light arc (42), a high-voltage ignition pulse (19) in the range from minus 18 kV to minus 30 kV is applied

to an ignition electrode (9) on an insulator member (8) by way of an ignition pulse supply (33, 39).

28. Method according to claim 26 or claim 27, **characterised in that**, for the maintenance of a getter metal light arc (42) between the cathode wire (10) and anode member (13) and the inner wall (3) of the high-vacuum vessel (5) to be coated, the anode member (13) and the inner wall (3) of the high-vacuum vessel (5) to be coated are held at ground potential (14) and the cathode wire (10) is held at a cathode potential (12) between -100 V and -300 V.
29. Method according to one of claims 26 to 28, **characterised in that** a metal plasma spray head (21) as metal plasma generator (7), which comprises an insulator member (8) having a cathode wire bundle (37) and ignition electrode (9) and the surrounding anode member (13), is, after ignition of the getter metal alloy plasma (6), moved linearly, by means of a linear high-vacuum layer port (22), within the interior (15) of the high-vacuum vessel (5) to be coated, the getter metal alloy (2) of the cathode wire bundle (37) being deposited, with plasma formation, on the inner wall (3) of the high-vacuum vessel (5) to be coated.
30. Method according to one of claims 26 to 29, **characterised in that** the getter metal alloy of the cathode wire (10), wound onto an insulator rod (24), of a metal plasma spray rod (23) as plasma generator (7) is deposited as a coating (1) on the inner wall (3) of the high-vacuum vessel (5) to be coated, starting from the end face (27) of the metal plasma spray rod (24), with successively occurring metal plasma formation of the cathode wire windings.
31. Method according to one of claims 26 to 30, **characterised in that** the metal plasma generator (7) is rotated, during deposition of the getter metal alloy (2), by means of a high-vacuum rotary port (28).
32. Method according to one of claims 26 to 31, **characterised in that** the thickness of the coating (1) of getter metal alloy (2) is, when the metal plasma spray rod (24) is used, controlled by the thickness of the cathode wire (10).

33. Method according to one of claims 26 to 31, **characterised in that** the thickness of the coating (1) of getter metal alloy (2) is, when the metal plasma spray head (21) is used, controlled by the speed of movement of the metal plasma spray head (21) in the axial direction of the high-vacuum vessel (5) to be coated.
34. Method according to one of claims 26 to 33, **characterised in that** an ion beam guidance tube (41) of an ion beam acceleration system is coated with the getter metal alloy (2) in order to make possible an ultra-high vacuum in the ion beam guidance tube (41).